

# Deployment, Support, and Use of Wind Erosion Equation (WEQ) Software for Resource Analysis and Planning

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## Introduction

Wind Erosion Equation version (WEQ) 2.2.0, one of 20 Field Office Computing System (FOCS) packages, is installed on all NRCS state, area, and county level field office servers, approximately 2800 installations agency-wide. The potential user base is estimated to be 6000 persons.

Field users may use WEQ to estimate wind erosion for each land unit in a management system, using either the critical period method or the management period method (figures 1 and 2). Erosion estimates for an alternative or planned conservation system may be compared to estimates for a benchmark condition. FOCS WEQ is based on technology developed by the Agricultural Research Service (Woodruff and Siddoway 1965, Skidmore and Woodruff 1968, and Bondy and others 1980).

This paper discusses the history of NRCS WEQ software and the requirements and issues associated with developing, distributing, supporting, and using a resource analysis software application on a large scale for conservation agency program delivery.

Figure 1. Crop rotation detail screen in the NRCS field office computing system wind erosion equation software application.

Crop Rotation Detail			
Crop: WHEAT		1 OF 1	
Previous Crop End Date:		Next Crop Start Date:	
Crop Variants		Operations	
Map Unit		Date	Operation or Event
SSAID-Symbol	Crop Variant		
87	AsB WHEAT; SPRING	07/04/90	HARVEST
87	AsC WHEAT; SPRING	04/05/91	SWEEPS; V-BLADE F
87	VcD WHEAT; SPRING	06/01/91	SWEEPS; V-BLADE F
87	VmD WHEAT; SPRING	08/01/91	SWEEPS; V-BLADE F
		09/15/91	DRILL; HOE-OPENER F
		/ /	
		/ /	
		/ /	
F3=Next Crop		F4=Previous Crop	F5=Save and Exit
F6=Delete Crop		F7=Next Region	F8=Add Crop
Accept crop; select, add, or delete crop; move to next/previous crop.			

Figure 2. The management period method screen used to compute wind erosion in the NRCS field office computing system wind erosion equation software application.

EVALUATE WIND EROSION BY MANAGEMENT PERIOD METHOD									
Business: Demo, John					System Label: dc01				
Client: Demo, John					System Name: Non Irrigated Cropla				
Tract/Field: 9999			05.00		Acres: 129.3				
Soil: ( 37) AsB - Ascalon									
I Factor: 134		C Factor: 150		EWE Location: NM Albuquerque					
Operation		Start Date	Crop	I	K	L	V (SGe)	EWE %	Per. Eros.
HARVEST		07/04/90	WHEAT	134	0.5	530	3812.2	57.5	0.00
SWEEPS; V-BLADE	F	04/05/91	WHEAT	134	0.5	530	3044.2	30.9	0.00
SWEEPS; V-BLADE	F	06/01/91	WHEAT	134	0.5	530	2430.4	17.2	0.00
SWEEPS; V-BLADE	F	08/01/91	WHEAT	134	0.5	530	1940.5	4.5	0.10
DRILL; HOE-OPENER	F	09/15/91	WHEAT	134	0.5	530	1127.8	89.9	15.43
Rotational Average Annual Erosion:								7.77	
Rotational Average Annual Erosion Posted as an Effect:								7.77	
F5=Save and Exit			F7=Crop Rotation			F9=Pop-up Window			
To select a soil and calculate the I Factor, use the pop-up window.									

### WEQ Development History

Development of a NRCS version of WEQ began in 1986 at the West National Technical Center in Portland, Oregon. Initial design team members consisted of regional and state agronomists and representation from the ARS Wind Erosion Research Unit (WERU) and the NRCS Field Office System Support Team. A DOS version was released in April 1988. A second version was produced in October 1989 compatible with the then field office CAMPS (Computer Assisted Management and Planning System) environment. Development responsibility was moved to the Technology Information System Division in Fort Collins, Colorado formed in late 1991, and the software was subsequently ported and integrated with FOCS.

Development of WEQ software has involved an agency sponsor, the design team, field user feedback, consultation with ARS scientists, a NRCS software project manager, and contract support services for systems analysis, programming, software testing, technical writing, and configuration management. Approximately 4 staff years of contractor support were used to produce the first two versions. From 1991 to present, about 7.5 staff years of contractor support has been devoted to WEQ development and maintenance. At any given time, no more than one programmer has been assigned to the application, and in recent years the programmer also has been involved with Revised Universal Soil Loss Equation (RUSLE)

development. A significant amount of time has been spent migrating WEQ to new platform configurations and adjusting to changes in the database schema of FOCS.

The FOCS WEQ software currently is maintained by the Information Technology Center in Fort Collins. The sponsor responsible for coordinating business requirements, implementation, and support is the NRCS agronomist stationed at the WERU, Manhattan, Kansas.

NRCS WEQ software releases include:

- Apr 1988 DOS Version
- Oct 1989 CAMPS version 1.5 (UNIX 3.2, Prelude database)
- Jul 1994 FOCS version 1.2.4 (UNIX 3.2 and Unixware 1.1, Informix 5.04)
- Jul 1996 FOCS version 2.1.0 (Unixware 2.03, Informix 5.06)
- Feb 1997 FOCS version 2.2.0 (Software upgrade)
- Jul 1997 FOCS version 3.1.0 (Unixware 2.03, Informix 7.13)

#### Contents of a WEQ Software Package

WEQ, as with any NRCS software application distributed to two or more regions, includes the following formal deliverables:

- Installation package containing application executables
- User guide, release notes, and as needed an installation guide, technical reference, and tutorial
- As-built system design documentation
- Source code, data model, and data dictionary
- Test plan, scripts, and cases
- Implementation plan

The WEQ software package and user documentation are distributed on a CD-ROM to all agency offices. The CD contains all contents required to establish a field office system, including system configuration utilities, commercial software, FOCS applications, and user documentation. A CD with updated content is distributed on approximately 6 month intervals. Currently, about 500 MB of files are provided on the CD. Approximately 750 MB of disk space must be reserved for a basic field office system.

Non-commercial software, including WEQ, also is placed on the agency FTP server. Minor upgrades and patches are posted to the FTP server between CD distributions.

#### Configuration Management and Software Development Requirements

WEQ software development, deployment, and maintenance complies with an agency configuration management plan. The current standard field office run-time configuration includes:

- NCR3333 486, AT&T Globalyst Pentium, DEC Prioris Pentium CPU's
- Unixware 2.03 operating system
- Informix 7.13 Standard Engine RDBMS
- IQ Report Writer 2.0

- UNIX Word 5
- Netscape 3.0
- Apache 1.2 Web Server
- Perl/Perlperl
- Plus many other required utilities

Software build and test configurations also are maintained, which are slight variations of the run-time configuration.

All agency national software is managed on a central version control system (CVS). All FOCS application installation packages are built on a single computer by an independent build agent. A standard script is used to build each package. Source code files are tagged in the CVS and referenced in the build script.

Changes that potentially impact other applications or foundation components of the system, or require a change to the run-time configuration, are mediated through a formal change control process.

Test plans include scripts and test cases for black box unit testing, system integration testing, performance testing, co-habitation testing, and installation/de-installation testing. An independent software test unit performs alpha testing. Live systems (beta) testing is conducted with at least one state and two field offices in each agency region. Application development teams use a standard problem log system to manage support call referrals, bug reports, enhancement requests, and regression fixes.

The WEQ software development team uses size and complexity metrics to monitor the quality of the source code. An example of size metrics for the three WEQ modules is shown in Table 1. Two example metric targets employed by the team are 2 comment lines per executable line of code, and less than 15 executable lines per C function. Metrics are used during weekly or periodic peer code reviews to identify problem areas needing attention.

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Table 1. Size metrics for the three software modules in the NRCS field office computing system wind erosion equation software application.

Size Metric	CRD	CPM	MPM	Total
Source code files	4	10	21	35
Total lines	3989	4767	11630	20386
Total executable lines**	1143	1374	3349	5866
Comment/executable line ratio	1.31	2.54	2.25	2.11
Number of functions	55	104	211	370
Average executable lines per function	16.7	9.2	11.1	11.4

\*\* Includes actual executable lines, declaration lines, and preprocessor lines

CRD - Crop Rotation Detail module

CPM - Critical Period Method module

MPM - Management Period Method module

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### Implementation and Support Requirements

FOCS WEQ requires support by a network of agency area and state agronomists, who maintain and distribute crop and field operation data, provide training, and answer business related support calls. All FOCS applications are supported by a national help desk at Fort Collins. Support calls are logged in a national help desk database, and standard solutions for frequently reported problems and issues are made available to users. Training on the use of the software is incorporated in courses on the use of the technology in agency programs.

### Current Agency Use of WEQ

Of the 20 key wind erosion states in the western half of the country, six are using FOCS WEQ for day-to-day conservation planning in field offices.

Several states use the management period method in FOCS for farm program compliance checks and appeals, and to support development of the Field Office Technical Guide. Some states have used the software for wide area, watershed level planning.

Three states report the DOS version is still used to some extent in field offices.

Due to constraints on development resources, the current FOCS WEQ software lacks the ability to save crop rotation detail records as templates. Many states have indicated they will more fully implement the software in all field offices when this feature is added, scheduled now for fall 1997.

Another factor affecting use are the limitations of the current text based interface. Migration to a more mainstream windows environment would improve screen navigation and facilitate use by others external to NRCS.

### WEQ and the Future USDA Service Center (Summation)

NRCS will move to a mainstream windows, web-enabled, geospatial common computing environment over the next 2-5 years as USDA consolidates information resources in county level service centers. However, it is unlikely NRCS will directly adapt WEQ, the Revised Wind Erosion Equation (RWEQ), or new Wind Erosion Prediction System (WEPS) to the new system. Instead, the developer likely will construct the model to integrate with the service center system and databases. This requires a common service center configuration management plan and application development standards, with appropriate change control processes. ARS has initiated MOSES (Modular Soil Erosion System), which integrates development of RUSLE2, RWEQ, Water Erosion Prediction System (WEPP), and WEPS and will interface with USDA service center systems.

### Literature Cited

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